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Our experience with hospitalized children with pertussis

Hospitalized children with pertussis

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Abstract
Aim: Pertussis is a lower respiratory tract infection caused by Bordetella pertussis, especially seen in children younger than six months, lasting more than fourteen days and developing with paroxysmal cough, inspiratory stridor and vomiting after coughing. In this study, it was aimed to present the demographic data and clinical characteristics of patients whose pertussis diagnosis was confirmed by clinical and Polymerase Chain Reaction tests in the infant service.
Material and Methods: Patients hospitalized with a diagnosis of pertussis between April 2014 and April 2019 were included in the study. Demographic data, symptoms, acute phase reactants, respiratory virus/bacterial sampling results, length of hospital stay and intensive care admissions were recorded.
Results: A total of 65 cases were included. Gender, age younger than or older than one year, low birth weight, and birth before 37 weeks were not associated with follow-up in the intensive care unit, whereas 5 of the 11 cases with other pathogens in addition to Bordetella pertussis were admitted to the intensive care unit. This rate was significantly higher than in cases where no additional pathogen was detected.
Discussion: As a result, it was thought that if there is a clinical suspicion in cases where the probable diagnostic criteria are not met, the diagnosis of pertussis should be confirmed by microbiological tests. In addition, it is thought that predictions can be made regarding the clinical course with the additional pathogen that can be detected using Polymerase Chain Reaction tests.

Keywords
Children, Polymerase Chain Reaction, Pertussis

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Introduction

Pertussis is an acute respiratory tract infection caused by the gram-negative coccobacillus Bordetella pertussis (B. Pertussis), which can cause morbidity and mortality [1,2]. About thirty million cases are seen in the world every year, and one hundred and sixty thousand deaths are reported in children under the age of five [3,4]. B. Pertussis-related morbidity and mortality remain important because vaccination does not provide life-long protection and infants younger than three months of age come into contact with sick cases [1,2].

Pertussis causes recurrent paroxysmal cough, inspiratory stridor, and post-cough vomiting after a clinical course similar to common upper respiratory tract infections [2]. While pertussis causes mild illness in older children and adults, it can cause serious complications and fatal infection in children younger than six months of age, especially in the first three months of life [2,5]. A probable case of pertussis is defined as the presence of at least one of the following conditions: in addition to a cough lasting for at least two weeks, the person has episodes of severe coughing, panting, or vomiting after coughing in the absence of any other problem that could cause vomiting after coughing. In the definitive case, the diagnosis of pertussis is made by the evidence of contact with an infected person or by microbiological testing (Polymerase Chain Reaction-PCR, culture) [6] (available at: https://asi.saglik.gov.tr/liste/20-bogmaca-hastalığı-nedir-belirtileri-nelerdir.html).

In this study, it was aimed to present the epidemiological data of patients diagnosed with pertussis and to provide information about laboratory tests, treatment and clinical course of pertussis in these patients.

Material and Methods

Inpatients diagnosed with pertussis by PCR testing, between April 2014 and April 2019 were evaluated based on their medical records. Macrolide antibiotics are administered to all pertussis patients hospitalized in accordance with the clinical protocol of our hospital. In addition, in cases with prolonged fever or elevated acute phase reactants suggestive of bacterial pneumonia in the history and physical examination, additional antibiotics to the macrolide group may be started after evaluation of chest X-ray.

Demographic data of the cases, birth weight, week of birth, admission time, symptoms at admission, duration of cough, co-morbidities of chronic lung or congenital heart disease, and family members with pertussis-like symptoms were recorded. White blood cell and lymphocyte count, C-reactive protein (CRP), pathogen results other than B. Pertussis in respiratory tract virus/bacteria samples, oxygen treatment, length of hospital stay, and pediatric intensive care unit (PICU) need were recorded. Patients were grouped as having white blood cell counts above or under 10,000/m^3 to compare PICU need and length of hospital stay. The study was performed according to the principles of the Declaration of Helsinki and after obtaining permission from the local ethics committee (26.12.2019, Decision number: 2019/18-37).

Statistical Analysis

The statistical analysis of the available data was performed using the IBM SPSS 24 program (Statistical Package for Social Sciences, Chicago, IL, USA) according to group characteristics. Before the cases were evaluated according to the number of cases in the groups, Skewness and Kurtosis values were checked, and the Shapiro-Wilk and Kolmogorov Smirnov tests were also performed in order to investigate their conformity with the normal distribution. After providing the assumption that the data were normally distributed, Fisher's Exact test, Chi-Square test and Student's t-test were used to compare means for two independent groups. The Mann Withney-U test was used for non-normally distributed variables. The significance level was accepted as $p<0.05$ in all statistical tests.

Results

A total of 65 patients who were diagnosed with pertussis based on clinical features and PCR test results were included in the study. The age range of the cases is shown in Figure 1. The majority of the cases were male. Twenty percent of the cases were premature and 30.8% were small for gestational age (SGA). There was no comorbidities in 73.8% of the patients. Family members with similar clinical symptoms consistent with pertussis were reported in 21 (32.3%) cases (Table 1). The months of admission in most cases were December and January (Figure 2).

While cough was detected as the presenting symptom in all

Table 1. aSocio-demographic characteristics, laboratory and PCR tests of the patients

Gender (n,%)	
Male	45 (69.2)
Gestational week (n,%)	
≤37+6 weeks	13 (20)
Birth weight (n,%)	
<2500 g	20 (30.8)
Presence of additional disease (n,%)	
Congenital heart disease	2 (3.1)
Chronic respiratory disease	12 (18,5)
Family member with similar clinical symptoms	
Sibling	9 (13.8)
Mother	7 (10.8)
Father	3 (4.6)
Cousin	1 (1.5)
Syptoms	
Cough	65 (100)
Runny nose	37 (56.9)
Paroxysmal cough	18 (27.7)
Fever	10 (15.4)
Vomiting after coughing	8 (12.3)
Cyanosis	6 (9.2)
Stridor	3 (4.6)
Apne	0
White blood cell count (x 103/ml)	13649±5437
Lymphocyte count (x 103/ml)	4749±2768
CRP value (mg/L) (med,min-max)	3.0 (0.0-272)
PCR test (n,%)	
Hemophilus influenzae	5 (7.6)
Chlamydia pneumoniae	2 (3.1)
Hemophilus influenza and Streptococcus pneumoniae	2 (3.1)
Streptococcus pneumoniae	2 (3.1)

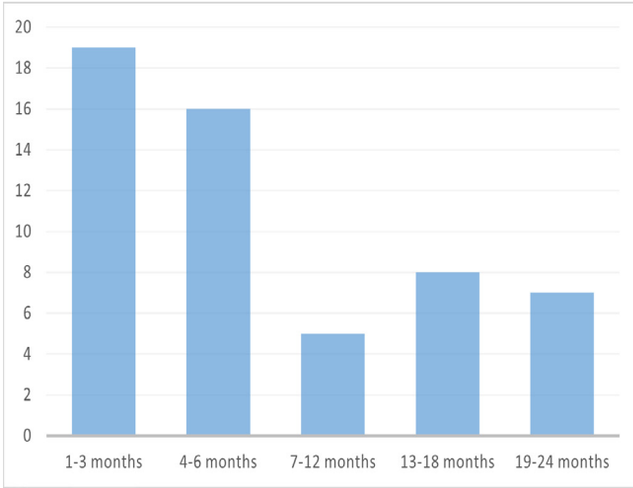

Figure 1. Age distribution of the patients

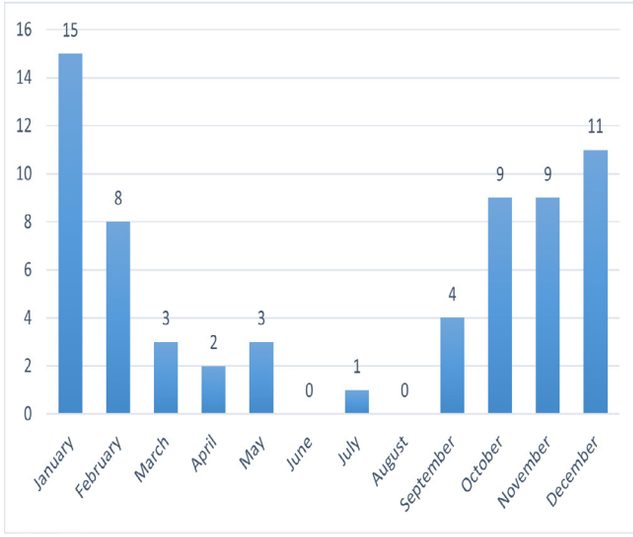

Figure 2. Months in which patients applied to the hospital

patients, vomiting was detected in only 8 (12.3%) patients (Table 1). The cough duration was 5.9±2.7 days. There were only 2 cases with a history of cough for 14 days or more. In 5 cases with fever, bacterial pneumonia was diagnosed in the follow-up and additional antibiotic treatment was administered.

The white blood cell count was found to be above 10,000/m³ in 42 (33.6%) patients, but there was no difference in terms of length of hospital stay or PICU need between the groups that were above and below this value (respectively p:0.534; p:0.941). All cases were positive for B. Pertussis . Additional pathogens were detected in 11 cases (16.9%) by PCR tests (Table 1). A total of 3 cases developed bacterial pneumonia with Chlamydia pneumoniae (1 patient) and Streptococcus pneumoniae (2 patients). The hospital stay was 6.8±3.1 days. Oxygen therapy was administered to 57 (87.7%) patients (during episodes or continuously). In the following period, 11 (16.9%) of the cases were referred to the PICU. No mortality was observed.

It was determined that gender (0.321), birth weight (p:0.659), week of birth (p:0.869), white blood cell count (0.435), lymphocyte count (0.111), and CRP (p:0.753) were not associated with the need for PICU. Five of the 11 patients with additional pathogens to B. Pertussis were referred to the PICU, and this rate was significantly higher than those with only B. Pertussis (p=0.006).

Gender (p:0.103), birth weight (0.678), week of birth (0.797), and presence of non-B. Pertussis pathogen (p:584) were not associated with length of hospital stay. No significant difference was found in terms of length of hospital stay and PICU need when the cases were grouped as below three months and above, or below one year old and above.

Discussion

This study was conducted to present the demographic data of the patients hospitalized for pertussis. The siblings were found to be the primary source of infection. The need for PICU in cases with co-infection was significantly higher than in patients with only B. Pertussis.

It was observed that birth weight, week of birth and age were not associated with length of hospital stay and length of stay in the PICU in children under two years of age. Although pertussis can be seen at any age, it has been shown that pertussis is more frequent and severe, especially in children younger than three months, whose vaccination has not yet been completed [3,4,7,8]. It was observed that week of birth and birth weight were not different between pertussis and non-pertussis cases or between severe and non-severe pertussis cases. Reviews also showed that birth weight was not cited as a pertussis risk factor [8,9-11]. Although it is more common under the age of one, we think that clinicians should be careful with every inpatient under the age of two regardless of month and week of birth.

In this study, siblings were reported as the main source of infection. Although siblings are the primary source of infection in many studies, research has shown that the carrier mothers and sick mothers are more frequent sources of infection than siblings. In many of these studies, it was stated that people with similar symptoms at home could be the source of infection without microbiological testing for B. Pertussis [2,12].

In the study, most cases did not have fever, and half of the patients with fever had additional bacterial pneumonia. Studies have reported that high fever may accompany pertussis, but its effect on the clinical course of the disease has not been clarified. In addition, it was thought that the absence of fever may make caregivers think that it was not a serious disease and may result in late admissions [2,12,13]. Therefore, it was thought that the presence of fever should be evaluated to rule out secondary infections.

In only two cases in the study, the cough lasted 14 days or longer. It has been reported in studies that families mostly present with paroxysmal cough symptoms, and cough lasting more than 14 days is seen only in 50% of cases. This suggests that a coughing period of less than 14 days may delay the diagnosis of pertussis [14,15]. In the literature evaluating diagnostic criteria, it has been shown that 9-27% of cases younger than six months will not be diagnosed unless PCR is performed [16,17]. Evaluation with PCR also helps to detect other pathogens that may accompany B. Pertussis [18]. For this reason, although the cough duration was not sufficient, it was thought that PCR test should be performed in the presence of other criteria.

In this study, white blood cell counts or lymphocyte counts were

not associated with the need for PICU. Although lymphocytosis is expected in 50-60% of pertussis cases, it is not always specific and causes cases to be diagnosed as acute bronchitis, bronchiolitis, pneumonia, or secondary infections [7,19]. In addition, high white blood cell and lymphocyte counts have been shown to be a risk factor for early-onset pneumonia and death [4,20]. For this reason, laboratory tests should be evaluated as a whole with the patient's clinic, and high white blood cell or lymphocyte counts should not be used alone for diagnosis or exclusion of the diagnosis.

Additional pathogens to B. Pertussis were detected in a minority of cases, and the need for PICU in these cases was significantly higher than in patients with B. Pertussis alone. In the literature, the length of hospital stay was found to be longer in patients with B. Pertussis and RSV. While many studies have found that co-infection has no effect on the clinical course of severe and non-serious pertussis, some studies have found more frequent pneumonia symptoms in cases with co-infection [10,11,21]. It was thought that if an agent other than B. Pertussis causes pneumonia, it may affect the clinical course

Conclusion

It was observed that most of the cases presented with a cough lasting less than 14 days. It was also determined that cases with additional pathogens needed more PICU. As a result, it was thought that if there is a clinical suspicion in cases where the probable diagnostic criteria are not met, the diagnosis of pertussis should be confirmed by microbiological tests. In addition, it is thought that predictions can be made about the clinical course with the additional pathogen that can be detected by Polymerase Chain Reaction tests.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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